the DIY lab guide

build your own tiny bio-reactor, no lab required

the pitch

Everything below is stuff you can do on a kitchen counter. No PhD, no fancy equipment, just jars, plants, and a willingness to check on them every couple of days. This is the companion to the Bioengineering for Sustainability workshop, run it solo, with friends, or with a whole classroom.

what you'll need

category	stuff
the living part	Duckweed, algae, or another small fast-growing plant
containers	3+ clear jars
water	Water samples or nutrient solutions
light	LED grow light or reliable natural light
testing	pH strips
measuring	Ruler, grid paper, or a phone camera
logging	A basic spreadsheet (Google Sheets works fine)
filtration	Sand, gravel, charcoal, cloth, or coffee filters

Cost: under $30 if you're buying everything, less if you raid your recycling bin for containers.

---

activity 1: how fast does duckweed actually grow?

The point: measure a real growth rate, not just "it got bigger."

1. Fill 3 jars with equal water (plain, nutrient-enriched, and a control).
2. Drop in the same small starting amount of duckweed in each (count the fronds if you're feeling precise).
3. Put them under the same light, same duration, no favorites.
4. Every 2 days, snap a photo from directly above and count/estimate coverage.
5. Log it: date, jar, coverage estimate.
6. After 10–14 days, graph coverage over time for each jar and see who won.

Why it matters: this is the biofuel story from Unit 2, biomass growth in real time.

---

activity 2: which filter actually works?

The point: find out if fancy filtration beats simple filtration.

1. Make "dirty water" (regular water + a bit of soil).
2. Build 3–4 filters in cut plastic bottles: sand only, charcoal only, sand/gravel/charcoal layered, and cloth/coffee filter only.
3. Pour equal dirty water through each, catch the output.
4. Check pH and eyeball clarity (1–5 scale works fine) for each.

5. Log the results.
6. Rank the filters. Spoiler: layered usually wins.

Why it matters: this is bioremediation, literally what duckweed does to water, just with materials instead of plants.

---

activity 3: does light actually matter?

The point: test how much light changes growth.

1. Set up 2–3 identical containers with duckweed (or another small plant).
2. Give each a different light situation: full grow light, indirect natural light, low light/shade.
3. Track growth the same way as Activity 1, every 2 days for 10–14 days.
4. Graph and compare.

Why it matters: photosynthesis 101, straight from Unit 2.

---

activity 4: design your own closed loop

The point: put the closed-loop idea from Unit 1 into practice.

1. Pick a pairing, e.g. fish tank water (nutrient-rich waste) feeding a duckweed jar, which then cleans the water for reuse.
2. Sketch it out: inputs, process, outputs, and where outputs get reused.
3. If you've got the materials, build a small version.
4. Track water quality before and after duckweed exposure to see if the loop is actually working.

Why it matters: this is where Units 1–3 all click together.

---

logging template

Date	Activity	Container/Group	Measurement	Value	Notes

safety, quickly

- Clean, food-safe containers only.
- Don't drink any water sample, including the "filtered" stuff.
- Wash your hands after handling pond water, soil, or duckweed.
- Adult supervision for anyone under 12.